

ENGINEERING-SCIENCE, INC.

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July 15, 1994

Mr. Marty Faile
AFCEE/ERT
8001 Arnold Drive
Brooks AFB, Texas 78235-5357

RE: AFCEE Bioventing Test Initiative Final Tables

Dear Marty:

Please find attached final tables and site figures for several sites at which 12 months of bioventing pilot testing have been completed. Specifically, final tables are attached for Westover AFB - Building 7701; Hanscom AFB - Building 1639; and Plattsburg AFB - Fire Training Pit 3. Also attached is the site figure for Charleston AFB - Site FT-03 for which the final tables were previously transmitted to you. The final table for the second Hanscom AFB site - Building 1812 will be completed pending collection of additional field data.

Please call me or Doug Downey at (303) 831-8100 if you have any questions.

Sincerely,

ENGINEERING-SCIENCE, INC.



Brian Blicher
Environmental Engineer

c.c.: Doug Downey
File

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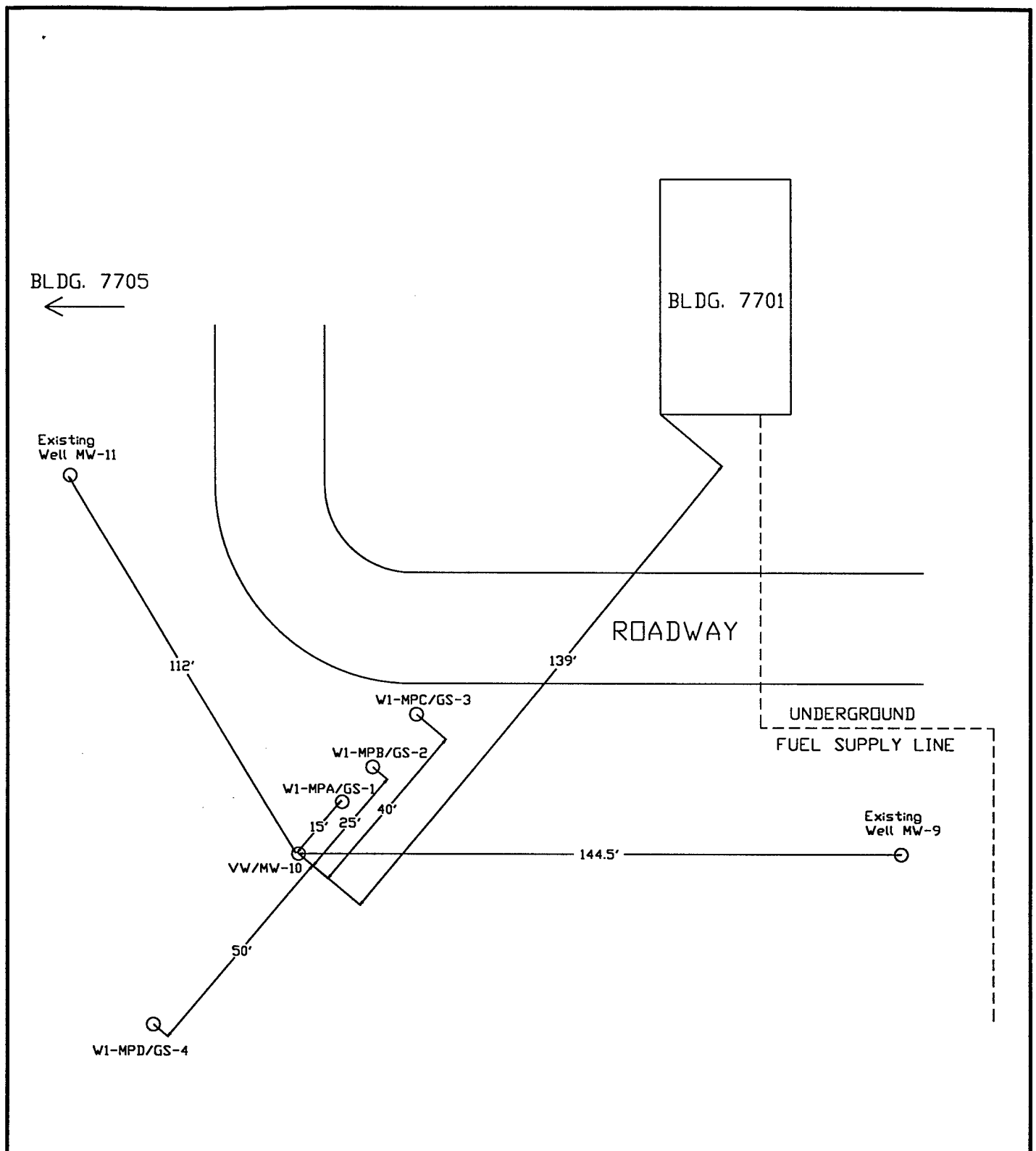


FIGURE 1

BUILDING 7701
AS-BUILT SITE PLAN

WESTOVER AFB, MASSACHUSETTS

ENGINEERING-SCIENCE, INC.
Denver, Colorado

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TABLE 1
BUILDING 7701
RESPIRATION AND DEGRADATION RATES
WESTOVER AFB, MASSACHUSETTS

Location - Depth	Initial (Oct. 1992) ^{a/}			6 - Month (Oct. 1993)			1 - Year (May 1994) ^{b/}		
	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year) ^{c/}	Soil Temperature (°C)	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year) ^{d/}	Soil Temperature (°C)	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)
MPA - 4.5	NS ^{e/}	NS	13.0	NS	NS	NS ^{f/}	NS	NS	NS ^{f/}
MPA - 8.5	0.0038	1600	NS	0.000070	30	NS	0.00047	210	NS
MPA - 13.5	0.0042	1700	15.5	0.00020	74	NS ^{f/}	0.00086	290	NS ^{f/}
MPB - 8.5	0.0057	2400	NS	0.00021	90	NS	0.00096	420	NS
MPB - 12.5	0.0083	3500	NS	0.00017	63	NS	0.0012	400	NS

^{a/} Initial installation, testing, and calculations were performed by Battelle.

^{b/} 1 - Year respiration testing was performed approximately 30 days after blower was shut off.

^{c/} Milligrams of hydrocarbons per kilogram of soil per year.

^{d/} Assumes moisture content of the soil is average of initial and final moistures.

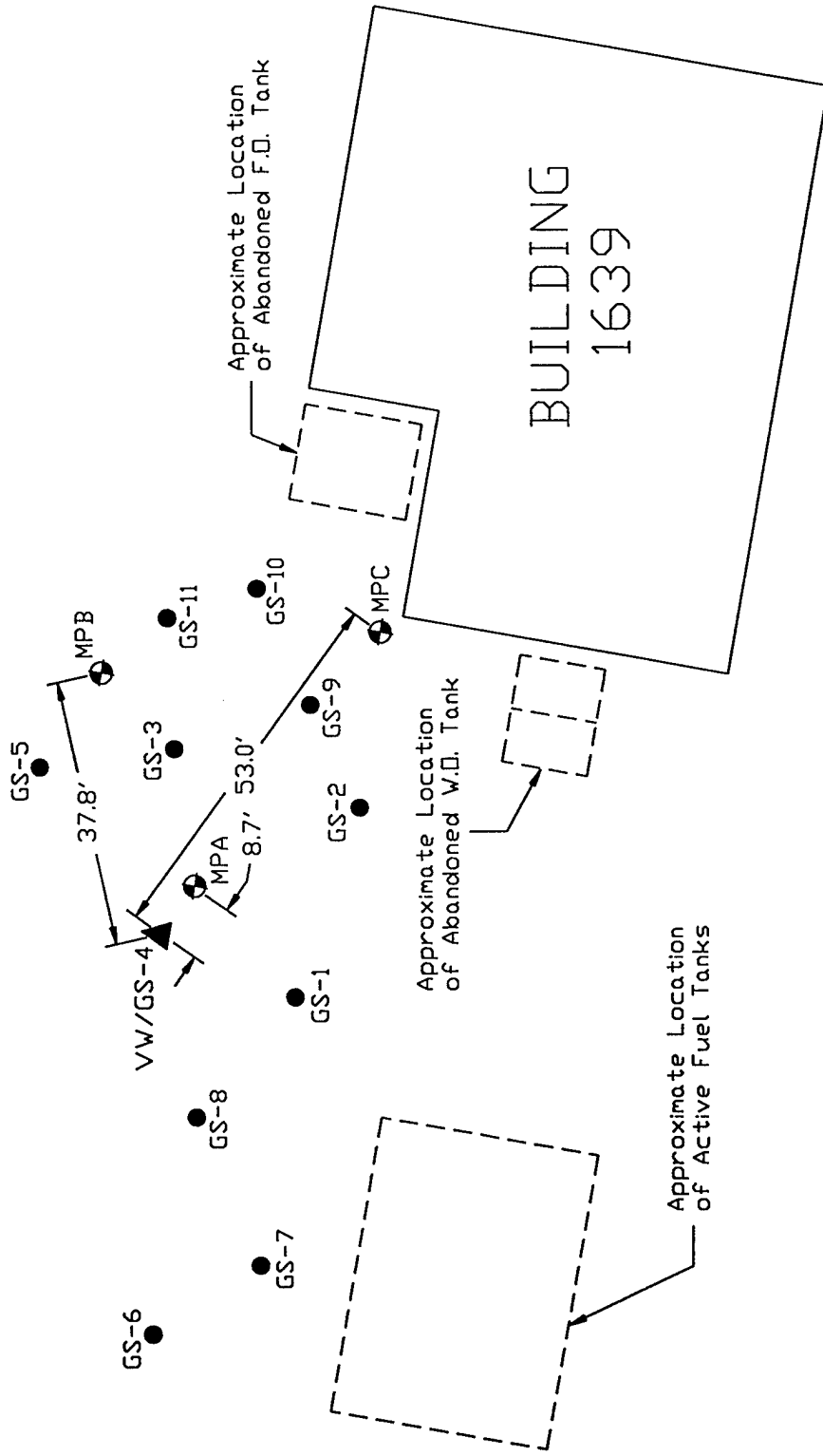
^{e/} NS = Not Sampled.

^{f/} Thermocouples could not be located.

TABLE 2
BUILDING 7701
INITIAL AND 1-YEAR SOIL AND SOIL GAS ANALYTICAL RESULTS
WESTOVER AFB, MASSACHUSETTS

Analyte (Units) ^{a/}	Sample Location - Depth (feet below ground surface)					
	VW (12-30)		MPA - 13.5		MPC - 14.5	
	Initial	1-Year ^{b/}	Initial	1-Year	Initial	1-Year
Soil Gas Hydrocarbons						
TVH (ppmv)	NS ^{c/}	93	NS	550	NS	1200
Benzene (ppmv)	NS	<0.005	NS	<0.012	NS	<0.025
Toluene (ppmv)	NS	<0.005	NS	<0.012	NS	0.37
Ethylbenzene (ppmv)	NS	<0.005	NS	<0.012	NS	0.084
Xylenes (ppmv)	NS	0.22	NS	0.49	NS	1.0
Soil Hydrocarbons	EX (9-9.5)		EX (12-12.5)			
	Initial ^{d/}	1-Year ^{e/}	Initial	1-Year		
TRPH (mg/kg)	<4.0	<5.0	<4.0	<5.0		
Benzene (mg/kg)	<0.0006	<0.0005	<0.0006	<0.0005		
Toluene (mg/kg)	<0.0007	<0.0005	<0.0007	<0.0005		
Ethylbenzene (mg/kg)	<0.0005	<0.0005	<0.0005	<0.0005		
Xylenes (mg/kg)	<0.0009	<0.0007	<0.0009	<0.0008		
Moisture (%)	4.4	3.7	5.0	8.3		

^{a/} TVH= total volatile hydrocarbons; ppmv=parts per million, volume per volume;
TRPH=total recoverable petroleum hydrocarbons; mg/kg=milligrams per kilogram.
^{b/} 1-Year soil gas samples collected on 5/17/94.
^{c/} NS=Not Sampled.
^{d/} Initial soil samples collected on 10/22/92.
^{e/} 1-Year soil samples collected on 4/27/94.



Not to scale

LEGEND

- ▲ INJECTION VENT WELL
- ⊕ VAPOR MONITORING POINT
- SOIL GAS SURVEY POINT

FIGURE 1

BUILDING 1639 AS-BUILT SITE PLAN

HANSCOM AFB, MASSACHUSETTS

ENGINEERING-SCIENCE, INC.

Denver, Colorado

TABLE 1
BUILDING 1639
RESPIRATION AND DEGRADATION RATES
HANSCOM AFB, MASSACHUSETTS

Location - Depth	Initial (October 1992) ^{a/}			6--Month (June 1993)			1--Year (March 1994) ^{b/}		
	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year) ^{c/}	Soil Temperature (°C)	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year) ^{d/}	Soil Temperature (°C)	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)
MPA-2.5	NS ^{e/}	NS	18.6	0.000062	18	20.4	NS	NS	NS ^{f/}
MPA-5	0.023	9800	19.7	0.0085	1200	19.0	0.00060	140	NS ^{g/}
MPB-2.5	0.0070	2900	NS	NS ^{g/}	NS ^{g/}	NS	0.00023	51	NS
MPB-5	0.0097	4000	NS	NS ^{g/}	NS ^{g/}	NS	0.00017	40	NS
MPC-6	0.012	4700	NS	NS ^{h/}	NS ^{h/}	NS	0.0022	520	NS

^{a/} Initial testing and calculations were performed by Battelle.

^{b/} 1--Year respiration test was performed approximately 30 days after blower system was shut off.

^{c/} Milligrams of hydrocarbons per kilogram of soil per year.

^{d/} Assumes moisture content of the soil is average of initial and final moistures.

^{e/} NS= Not Sampled.

^{f/} Thermocouple leads were destroyed by ice in well head.

^{g/} Respiration test was not performed at this point due to water in monitoring points.

^{h/} Respiration test was not performed at this point due to initial oxygen concentration in point being 0.0 percent.

TABLE 2
BUILDING 1639
INITIAL AND 1-YEAR SOIL AND SOIL GAS ANALYTICAL RESULTS
HANSCOM AFB, MASSACHUSETTS

Analyte (Units) ^{a/}	Sample Location – Depth (feet below ground surface)											
	MPA-2.5		MPA-5		MPB-2.5		MPB-5		MPC-3.5		MPC-6	
	Initial ^{b/}	1–Year ^{c/}	Initial	1–Year	Initial	1–Year	Initial	1–Year	Initial	1–Year	Initial	1–Year
Soil Gas Hydrocarbons												
TVH (ppmv)	5600	130	19000	16	2700	59	3200	19	280	1500	11000	9800
Benzene (ppmv)	5.2	0.21	27	<0.002	2.8	0.32	2.4	0.11	0.44	<0.05	11	49
Toluene (ppmv)	4.2	<0.002	35	<0.002	1.3	1.7	0.84	0.35	0.13	7.0	20	45
Ethylbenzene (ppmv)	1.1	0.035	10	0.006	0.84	0.11	0.42	0.044	0.11	1.0	9.3	1.6
Xylenes (ppmv)	2.9	0.058	30	0.011	1.9	2.5	1.5	0.97	0.37	8.7	67	21
Soil Hydrocarbons												
TRPH (mg/kg)	22	39.3	15	310	<4	26						
Benzene (mg/kg)	0.048	0.0081	0.67	<0.0006	1.0	0.086						
Toluene (mg/kg)	0.020	0.02	0.27	0.0022	4.3	0.16						
Ethylbenzene (mg/kg)	0.013	0.0088	0.43	0.0015	1.3	0.21						
Xylenes (mg/kg)	0.020	0.013	0.45	0.0096	12	0.89						
Moisture (%)	22.2	20.7	21.8	12.2	5.8	13.0						

a/ TVH= total volatile hydrocarbons; ppmv=parts per million, volume per volume;

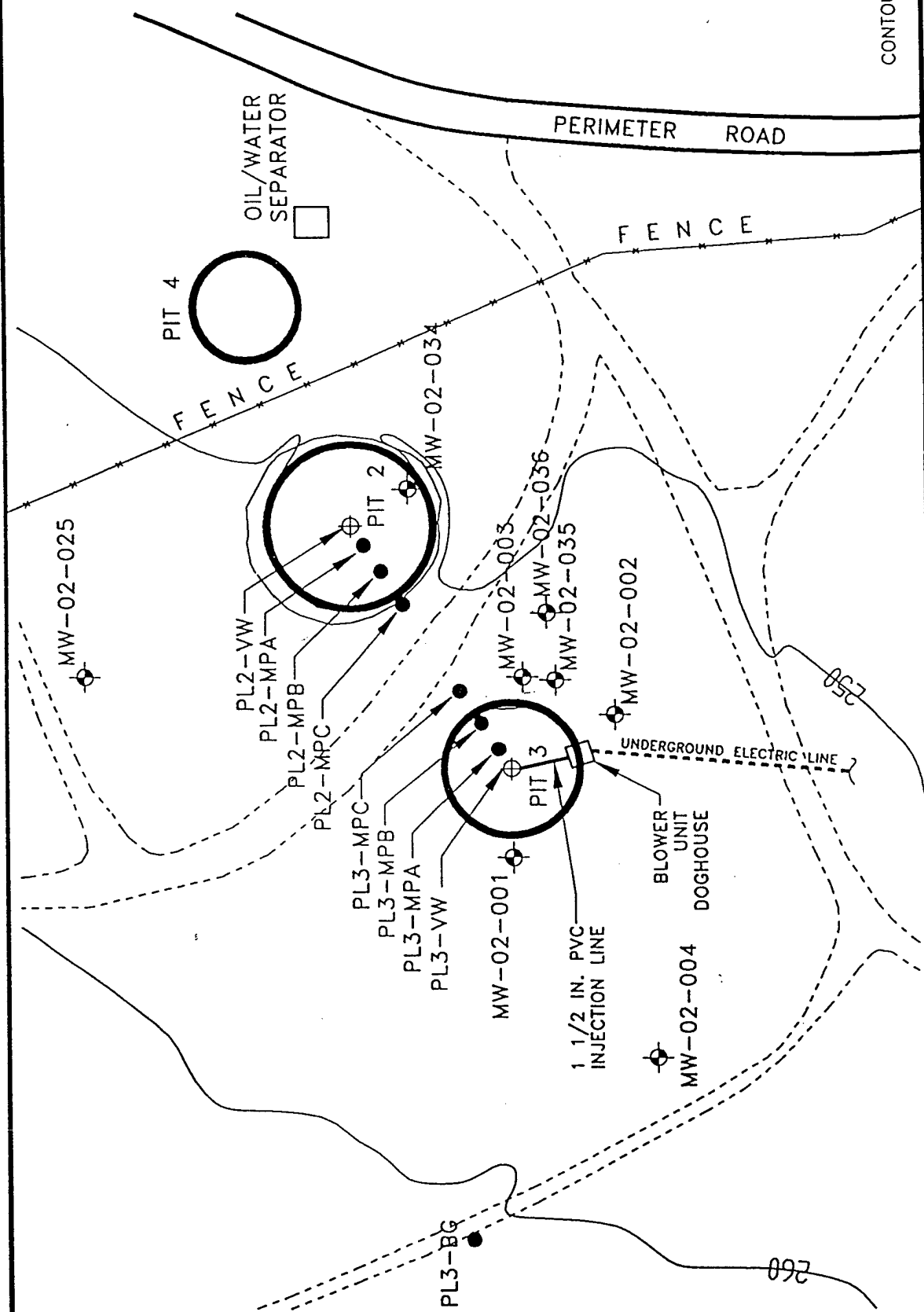
TRPH=total recoverable petroleum hydrocarbons; mg/kg=milligrams per kilogram.

b/Initial soil gas samples collected on 10/12/92.

c/ 1-Year soil gas samples collected on 3/8/94.

d/Initial soil samples collected on 10/2/92.

e/ 1 – Year soil samples collected on 3/23/94.



CONTOUR INTERVAL 10 FEET

FIGURE 1

AS-BUILT VENT WELL,
MONITORING POINT AND
BLOWER LOCATIONS
FIRE TRAINING PIT 3

Plattsburg AFB, New York
ENGINEERING-SCIENCE, INC.
Syracuse, New York



LEGEND:

- MW-02-002 EXISTING MONITORING WELL
- VENT WELL
- VAPOR MONITORING POINT (VMP)

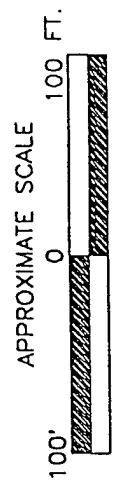


TABLE 1
FIRE TRAINING PIT 3
RESPIRATION AND DEGRADATION RATES
PLATTSBURGH AFB, NY

Location - Depth	Initial (July 1992)		6 - Month (June 1993) ^{b/}		1 - Year (March 1994) ^{c/}	
	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year) ^{a/}	Soil Temperature (°C)	K _o (% O ₂ /min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)
PL3-MPA-9	0.014	4300 ^{d/}	15.0	0.0028	690 ^{d/}	14.3
PL3-MPA-29	NS ^{e/}	NS	7.8	NS	NS	7.6
PL3-MPB-29	NS	NS	NS	NS	NS	NS
				0.0022	390 ^{d/}	7.9
				NS	NS	14.0
				0.00092	270	NS

^{a/} Milligrams of hydrocarbons per kilogram of soil per year.

^{b/} Assumes moisture content of the soil is average of initial and final moistures.

^{c/} 1 - Year respiration test was performed approximately 30 days after blower system was shut off.

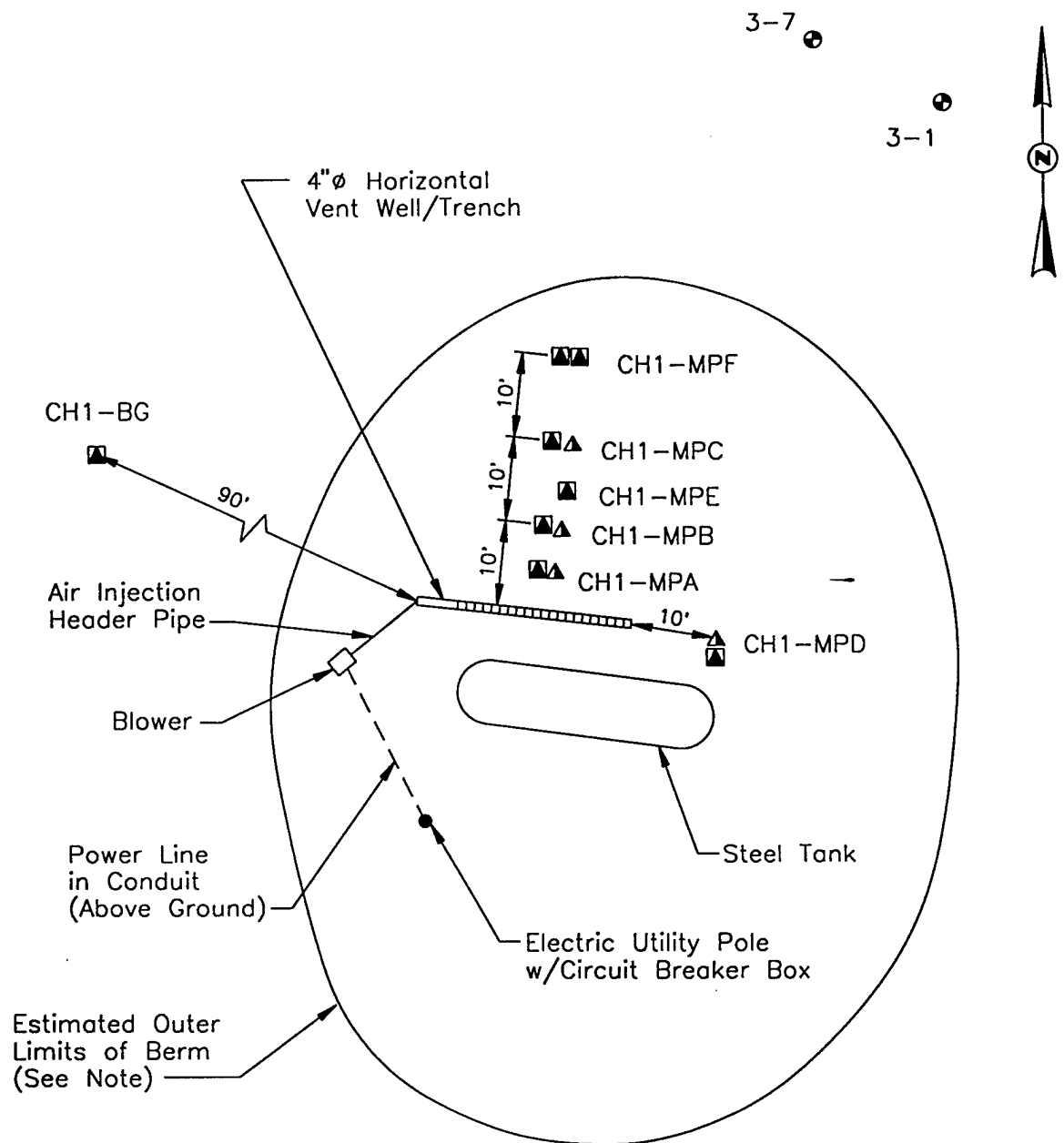
^{d/} Assumes average moisture content of soil samples from VW - 17 and MPA - 2.

^{e/} NS=Not Sampled.

TABLE 2
FIRE TRAINING PIT 3
INITIAL AND 1-YEAR SOIL AND SOIL GAS ANALYTICAL RESULTS
PLATTSBURGH AFB, NY

Analyte/ (Units)	Sample Location-Depth (feet below ground surface)					
	MPA-9			MPB-29		
	Initial	1-Year	Initial	Initial	1-Year	1-Year
Soil Gas Hydrocarbons						
TVH (ppmv)	8,400	16	35	3.8		
Benzene (ppmv)	6.9	<0.002	0.02	<0.002		
Toluene (ppmv)	21	0.030	0.10	<0.002		
Ethylbenzene (ppmv)	3.2	0.008	0.03	<0.002		
Xylenes (ppmv)	27	0.024	0.33	<0.002		
Soil Hydrocarbons						
	VW-17		MPA-2		MPA-25	
	Initial	1-Year	Initial	1-Year	Initial	1-Year
TRPH (mg/kg)	9.0	1040	19000	9440	NS	1380
Benzene (mg/kg)	<0.0006	<0.14	<0.0006	<0.28	NS	<0.13
Toluene (mg/kg)	0.024	<0.14	0.043	<0.28	NS	<0.13
Ethylbenzene (mg/kg)	0.001	<0.14	0.014	1.8	NS	<0.13
Xylenes (mg/kg)	0.047	<0.19	0.088	2.9	NS	0.24
Moisture (%)	3.4	10.5	6.1	10.4	NS	5.1

- ^{a/} TVH = total volatile hydrocarbons; ppmv = parts per million, volume per volume;
 TRPH = total recoverable petroleum hydrocarbons; mg/kg = milligrams per kilogram.
^{b/} Initial soil gas samples collected on 7/15/92.
^{c/} 1-Year soil gas samples collected on 3/1/94.
^{d/} Initial soil samples collected on 7/7/92.
^{e/} 1-Year soil samples collected on 3/24/94.
^{f/} NS = Not Sampled.



LEGEND

- CH1-MPA Permanent soil vapor/pressure monitoring point.
- CH1-MPA Temporary soil vapor/pressure monitoring point (soil gas probe).
- CH1-BG Temporary background monitoring point.
- 3-7 Groundwater monitoring well.

NOTE: Soil berm has approximate elliptical dimensions.

FIGURE 1

AS-BUILT VENT WELL, MONITORING POINT, AND BLOWER LOCATION

SITE FT-03

Charleston AFB, South Carolina

ENGINEERING-SCIENCE, INC.

Raleigh-Durham, South Carolina